

Claims

1. A method for processing video images to detect an event of interest, comprising the steps of :

- receiving a video signal (10) representing the video images to be processed;
- 5        - extracting (1) at least one point feature from the video signal ;
- tracking (2) the position and movement of the at least one point feature within the video images to generate a corresponding at least one track, each representing a corresponding point feature;
- 10      - using (3) an iterative learning process to derive a normal pattern of behaviour for each track;
- comparing (4) present behaviour of the at least one track to the respective normal pattern of behaviour; and
- in response to the present behaviour falling outside the normal pattern of behaviour, generating (5) an alarm signal (20).

15 2. A method according to claim 1 wherein the alarm signal (20) causes at least one of the following effects:

- draw the attention of an operator;
- place an index mark at the appropriate place in recorded video data; and
- trigger selective recording of video data.

20 3. A method according to claim 1 or claim 2, wherein the learning process (3) accumulates data representing the behaviour of the track(s) over a period of time in a four-dimensional histogram, said four dimensions representing x-position, y-position, x-velocity and y-velocity, of the track(s) within the video image.

25 4. A method according to claim 3 wherein the learn behaviour stage segregates the tracks according to a velocity threshold; wherein tracks moving at a velocity below the velocity threshold are considered stationary while tracks moving at a

velocity in excess of the velocity threshold are considered mobile; wherein data concerning the mobile tracks is stored in said four-dimensional histogram, data concerning the stationary tracks being stored in a two-dimensional histogram, said two dimensions representing x-position and y-position within the video image.

5. 5. A method according to either claim 3 or claim 4 wherein a cell size of the four-dimensional histogram varies in accordance with a measured speed in the image of each respective track.
10. 6. A method according to any of claims 3-5 wherein the histogram is periodically de-weighted in order to bias the result of the learning process (3) towards more recent events.
7. 15. A method according to any preceding claim wherein the comparison process (4) classifies a track according to a comparison of the frequency of occupation of the corresponding histogram cell with an occupancy threshold.
15. 8. A method according to claim 7 wherein the comparison process (4) acts to classify as normal behaviour a track adjacent or near a cell which is above the occupancy threshold, despite the track appearing in a cell below the occupancy threshold, where one cell is considered to be near another if the distance between them is below a predetermined distance threshold.
20. 9. A method according to any preceding claim wherein abnormal tracks are filtered, whereby an active alarm signal (20) is generated in response to an abnormal track which resembles a number of other abnormal tracks, in terms of at least one of position, velocity and time.
10. 25. A method according to any preceding claim wherein abnormal tracks are filtered, whereby an active alarm signal (20) is generated in response only to an abnormal track which has been classified as abnormal on a predetermined number of occasions.

11. A method according to any preceding claim wherein abnormal tracks are filtered, whereby an active alarm signal (20) is generated in response only to a track being classified as abnormal for the first time.
12. A method according to any preceding claim wherein abnormal tracks are filtered, whereby an active alarm signal (20) is generated only in response to a filtered version of the classification rising above a predetermined threshold value.
13. A method according to any preceding claim wherein subsequent active alarm signals (20) are inhibited for a predetermined time interval after a first active alarm signal (20) has been produced.
14. A method according to any preceding claim wherein subsequent active alarm signals (20) are inhibited if caused by an abnormal track within a predetermined distance of another track which has previously generated an alarm.
15. Apparatus for processing video images to detect an event of interest, comprising:
  - a source of video images, producing a video signal (10) representing the video images to be processed;
  - a feature extraction device (1) receiving the video signal and producing data (12) representing at least one point feature detected within the image;
  - a feature tracking device (2) receiving the data (12) representing point features and producing data (14) representing tracks, being representative of the position and speed of each respective point feature, within the image;
  - a learning device (3) receiving the data (14) representing the tracks and producing a signal (16) representing a range of behaviour considered normal by the learning device, in response to operation of a learning process on the data (14) representing the tracks;
  - a classification device (4) receiving both the signal (16) representing the normal range of behaviour of the tracks and the data (14) representing the

tracks, being adapted to compare the signal (16) and the data (14) and to issue a normal/abnormal signal (18) in accordance with the outcome of such comparison; and

- an alarm generation device (5) receiving the normal/abnormal signal (18) and generating at least one active alarm signal (20) in response to the normal/abnormal signal indicating abnormal behaviour of at least one track.

5            16. Apparatus substantially as described and/or as illustrated in the accompanying figure.

10          17. A method substantially as described and/or as illustrated in the accompanying figure.